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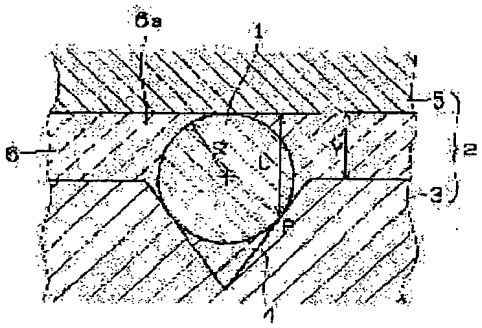
(54) OPTICAL FIBER ARRAY

(57)Abstract:
PROBLEM TO BE SOLVED: To make separation or the like hard to occur in a holding member even under a severe environment and to maintain superior properties.
SOLUTION: In an optical fiber array, the tip end of an optical fiber is stored in the holding member 2 consisting of a base plate 3, which is formed with a storing groove V-shaped in cross section (V-groove 4) for storing the optical fiber 1 on the upper face, and a cover plate 5 for covering the upper face of the base plate 3; then, the optical fiber 1 is fixed in the storing groove by filling an adhesive between the base plate 3 and the cover plate 5. In this optical fiber array, a distance Y between the base plate 3 and the cover plate 5, and a distance L between a contact point of the optical fiber 1 with the storing groove and the cover plate 5, are designed to be in such a relation as L/6≤Y≤L



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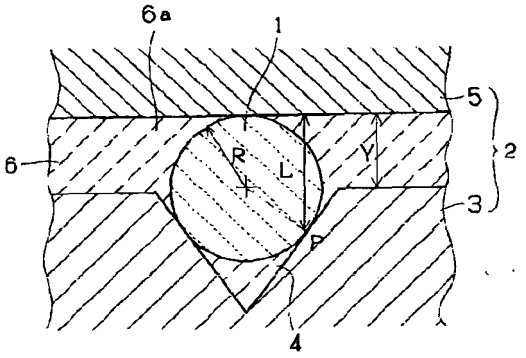
(54)【発明の名称】　光ファイバアレイ

(57)【要約】
【課題】　過酷な環境下であっても保持部材の剥離等が発生し難く、良好な特性を維持させる。
【解決手段】　上面に光ファイバ１を収容する断面Ｖ字状の収容溝（Ｖ溝４）を形成した基板３と、該基板３の上面を覆う蓋板５とから成る保持部材２に光ファイバ先端を収容し、接着剤を基板３と蓋板５の間に充填して光ファイバ１を収容溝に固定した光ファイバアレイにおいて、基板３と蓋板５との間の距離Ｙが、収容した光ファイバ１と収容溝との接点から蓋板５までの距離Ｌに対して、Ｌ／６≦Ｙ≦Ｌとした。



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【特許請求の範囲】

【請求項１】　上面に光ファイバを収容する断面Ｖ字状の収容溝を形成した基板と、該基板の上面を覆う蓋板とから成る保持部材に光ファイバ先端裸部を収容し、接着剤を基板と蓋板の間に充填して光ファイバを収容溝に固定した光ファイバアレイにおいて、最外部にあたる収容溝の中心軸から基板端部までの距離が光ファイバ半径の５倍以上有し、基板と蓋板との間の距離Ｙが、収容した光ファイバと収容溝との接点から蓋板までの距離Ｌに対して、Ｌ／６≦Ｙ≦Ｌであることを特徴とする光ファイバアレイ。

【請求項２】　収容溝に収容した光ファイバの基板から突出した部位の高さが、基板と蓋板との距離Ｙに略等しい請求項１記載の光ファイバアレイ。

【請求項３】　基板と蓋板との距離Ｙが、Ｌ／４≦Ｙ≦Ｌである請求項１又は２記載の光ファイバアレイ。

【請求項４】　接着剤がエポキシ系である請求項１乃至３の何れかに記載の光ファイバアレイ。

【請求項５】　蓋板の幅と基板の幅が異なる請求項１乃至４の何れかに記載の光ファイバアレイ。

【請求項６】　収容溝形成面の後部に光ファイバ被覆部を載置する載置面を設け、該収容溝形成面と載置面との間に段差を設けて光ファイバを載置及び収容した請求項１乃至５の何れかに記載の光ファイバアレイ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、保持部材を装着して光ファイバを所定間隔に整列保持した光ファイバアレイに関し、詳しくはその保持部材の剥離防止技術に関する。

【０００２】

【従来の技術】光ファイバを整列固定したファイバアレイは、図４に示すように形成されている。図４において、１２は基板１３と蓋板１５とから成る保持部材であり、基板には断面Ｖ字状のＶ溝１４（収容溝）が複数列形成され、光ファイバ（光ファイバ裸部）１を個々のＶ溝１４に収容し、接着剤を充填すると共に蓋板１５を被せて光ファイバ１を挟み込み、光ファイバ１をＶ溝内に接着固定している。また、１ａは被覆された光ファイバであり複数本連結されてファイバリボン１６を形成している。保持部材１２は例えばガラス板を加工して形成され、Ｖ溝１４は鏡面研磨された基板表面に平行に形成されている。また、隣接するＶ溝間は狭いため基板１３と蓋板１５との接着を確実にするために接着面をＶ溝の東の左右端部に広く形成してある。

【０００３】

【発明が解決しようとする課題】ところが、上述するようなファイバアレイは野外の過酷な環境下におかれることが多く、６０℃の高温から－４０℃の低温にさらされたり、砂漠環境から高温多湿の環境にさらされたりする。光ファイバアレイはこうした過酷な環境下で、長期間安定して良好な特性を維持しなければならない。しかし、上記ファイバアレイはこのような環境下に長期間さらされた場合、経時変化により光ファイバ１を固定している基板１３と蓋板１５とが剥がれて、光ファイバの固定が不安定になる現象があった。

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【０００４】光ファイバは光軸が所定位置からずれると、接続している光学部品との間で伝送損失が大きくなってしまうため、例えば０．５μｍ以下といった極めて高い位置精度が要求されている。そのため、上記剥がれ現象が発生すると位置ずれが発生して伝送特性が劣化する事になる。また、最終的には光ファイバが基板から抜け落ちてしまう場合もあり得る。そこで、本発明の課題は、過酷な環境下であっても保持部材の剥離等が発生し難く、良好な特性を維持させることである。

【０００５】

【課題を解決するための手段】上記課題を解決するため、請求項１の発明は、上面に光ファイバを収容する断面Ｖ字状の収容溝を形成した基板と、該基板の上面を覆う蓋板とから成る保持部材に光ファイバ先端を収容し、接着剤を基板と蓋板の間に充填して光ファイバ裸部を収容溝に固定した光ファイバアレイにおいて、最外部にあたる収容溝の中心軸から基板端部までの距離が光ファイバ半径の５倍以上有し、基板と蓋板との間の距離Ｙが、収容した光ファイバと収容溝との接点から蓋板までの距離Ｌに対して、Ｌ／６≦Ｙ≦Ｌであることを特徴とする。

【０００６】請求項２の発明は、請求項１の発明において、収容溝に収容した光ファイバの基板から突出した部位の高さが、基板と蓋板との距離Ｙに略等しいことを特徴とする。

【０００７】請求項３の発明は請求項１又は２の発明において、基板と蓋板との距離Ｙが、Ｌ／４≦Ｙ≦Ｌであることを特徴とする。また、請求項４の発明は、請求項１乃至３の何れかの発明において、接着剤がエポキシ系であることを特徴とする。

【０００８】請求項５の発明は、請求項１乃至４の何れかの発明において、蓋板の幅と基板の幅が異なることを特徴とする。

【０００９】請求項６の発明は、請求項１乃至５の何れかの発明において、収容溝形成面の後部に光ファイバ被覆部を載置する載置面を設け、該収容溝形成面と載置面との間に段差を設けて光ファイバを載置及び収容したことを特徴とする。

【００１０】発明者は、剥がれの原因が、収容溝最外部外側に広がる基板と蓋板との間の接着剤層が薄いことにより、Ｖ溝に円形の光ファイバを収容した場合に生じる光ファイバ周辺（収容溝内）の接着剤溜まり部に起因する接着剤硬化の際の収縮や接着剤と基板、或いは接着剤と蓋板の熱膨張率の違い、又は、湿度が加わった場合の

接着剤の膨潤によるＶ溝内の接着剤の応力集中を接着剤層が吸収しきれないことにあることを実験により突き止めた。

【００１１】ファイバアレイは接着剤にて実装されており、且つ複雑な形状をしているので、部分的な強い応力や基板と蓋板間の全体応力等様々な応力が存在する。部分的な応力としては上述するようにＶ溝内のファイバ周辺等樹脂溜り部に発生し、これは図５のＶ溝１４に収容した光ファイバの断面説明図に示すように、図５のＡに示す接着剤溜り部の応力がＢに示す部分に加わり、この部分の接着剤層が薄いと、この応力を吸収しきれずにＢの部分に剥離が発生するメカニズムだと考えられる。そして、例えばＢ等に剥離が発生すると、全体応力がこの部分にも加わることや、剥離部分に水分が侵入していくことにより、その剥離がさらに広がって行く。このような接着剤の作用に対し、上述構成とすることで接着剤層が応力集中を吸収することが可能となり、過酷な環境下であっても光ファイバと基板或いは固定基板との間で剥離が発生し難く、良好な特性を維持させることができる。

【００１２】

【発明の実施の形態】以下、本発明を具体化した実施の形態を、図面に基づいて詳細に説明する。図１は本発明に係る光ファイバアレイの断面拡大図であり、１は光ファイバ（裸光ファイバ）、２は基板３と蓋板５から成る保持部材であり、基板３にはＶ溝４が形成され、Ｖ溝４には光ファイバ１が収容されている。また、光ファイバ１の周囲及び基板３と蓋板５の間は接着剤６ａが充填されている。尚、Ｖ溝４の開き角は例えば７０°であり、光ファイバ１の半径は例えば６２．５μｍで形成されている。

【００１３】Ｖ溝４は、光ファイバ１を収容した状態で光ファイバの一部が基板上面から僅かに突出するよう形成され、その突出長が基板３と蓋板５との間に形成される接着剤層６の厚みと略等しくなるよう形成されている。また、光ファイバ１の半径Ｒに対して、基板３の最外部収容溝の中心から基板端部までの距離Ｍ（図３に示す。）を光ファイバ半径の５倍以上としてある。そして、この接着剤層６の厚さＹを、Ｖ溝４と光ファイバ１との接点Ｐから蓋板５までの距離Ｌを基準に次のように規定している。

Ｌ／６≦Ｙ≦Ｌ　・・（範囲１）

【００１４】接着剤層６の厚さＹをこの範囲にすることで、後述する実験結果に示すように接着剤層６が接着剤の硬化の際に発生する収縮、或いは基板３や蓋板５との熱膨張率の違い或いは膨潤率の違いから発生する応力を吸収し、過酷な環境下でも剥がれることなく安定した特性を維持することができる。また、接着剤の観点から見ると、接着剤による応力は接着剤のヤング率が高いほど特に大きくなる。例えば、エポキシ系の接着剤を用いる場合はアクリル系やシリコン系の接着剤と比較して一般的にヤング率が高いので、応力も大きくなり本願の接着層構造が有効となる。特にヤング率が２ｋｇｆ／ｍｍ^{2}以上のエポキシ系接着剤を用いると応力が特に大きくなるので、本願の接着層構造が効果的である。

【００１５】尚、ここで言う接着剤とは、少なくともＶ溝周辺（裸ファイバ・蓋板と基板の接着固定）の接着に使用するものを示す。また、光ファイバ１がＶ溝４の斜面に確実に２点接触するためには、加工精度や測定精度を考慮すると理論的な接触点から現実的な接触点を１０μｍ程度余裕を持たせて上方へ移動した点とするのが好ましく、この場合、上記（範囲１）は（Ｌ－１０μｍ）／６≦Ｙ≦（Ｌ－１０μｍ）となる。

【００１６】表１は、接着剤層６の厚さＹを変えて作成したファイバアレイにより環境試験（煮沸試験）を行って接着部の変化を対比した表であり、ファイバアレイを沸騰水に入れ、所定時間経過後の剥がれの発生状況を調べたものである。表において、○は剥がれの発生がみられない良好な状態、△は一部に剥がれが発生した状態、×は広範囲に剥がれが発生した状態を示している。

【００１７】

【表１】

接着剤層の厚さ	煮沸時間			
Ｙ	15hr	36hr	60hr	
Ｌ／2	○	○	○	写真
Ｌ／4	○	○	○	
Ｌ／6	○	○	△	
Ｌ／8	×	×	×	写真

【００１８】また、図２は上記環境試験によるファイバアレイの接着部の変化の様子を説明する為の写真画像であり、（ａ）～（ｄ）は表１のＹ＝Ｌ／２の写真、（ｅ）～（ｈ）は従来のＹ＝Ｌ／８の写真である。尚、写真を見やすくするため反転処理して掲示している。また、図２の各写真に撮影されている光ファイバアレイの保持部材３の概略を図３に示している。

【００１９】図３は保持部材の平面図であり、図示する

ように環境試験に供した保持部材２は、基板３がＶ溝８本から成る群を３群形有している。光ファイバアレイは光ファイバ１を保持部材２に収容して接着剤を塗布した後、蓋板５を貼着して形成され、Ｖ溝の大きさを変えることで光ファイバ１の基板上の突出量を変えて、接着剤の厚みＹが所望厚になるようにしている。そして、図２において、左側の写真（ａ）～（ｄ）は６０時間煮沸しても変化はみられないが、右側の写真（ｅ）～（ｈ）は１５時間後から基板左右の主接着面８，８に斑点状の模様が発生し、各光ファイバ群の間においても煮沸前の状態とは異なる部分が発生していることが確認できる。これらは、接着剤が剥離した部位であり、これらの写真から右側即ち接着剤層の厚さＹがＬ／８の場合は１５時間の煮沸で既に剥離が発生していることがわかる。また、左側即ちＹがＬ／２のものは、６０時間煮沸しても剥離が発生していない。

【００２０】このように、試験結果から最外部収容溝の中心軸から基板端部までの距離が光ファイバ半径の５倍以上とし、接着剤層厚ＹがＬ／６以上であれば、殆ど剥離は発生することなく、過酷な環境下でも使用可能であると判断することができる。更に、接着剤層厚ＹがＬ／４以上であれば、剥離は発生せず良好な状態を維持し続けると判断することができる。

【００２１】ところで、光ファイバアレイは蓋板５でファイバを基板Ｖ溝４に押さえた形が一般的であり、光ファイバアレイの先端部端面は光学研磨が施されるが、ファイバ端面は所望の角度にする必要があるので、通常Ｖ溝４に平行な側面を研磨時の基準として研磨が行われる。この際、基板３の側面をＶ溝４に平行にすることは加工上容易であるが、蓋板５は光ファイバ１の上に乗せるだけなので、蓋板５の側面と光ファイバ１を平行にすることは容易ではない。

【００２２】そのため、研磨基準面は、基板３の側面にするのが自然であり、この状態を確保する為に、蓋板５は基板３の左右外側にはみ出さないようにする。この方策としては蓋板５の幅を基板３の幅より狭くすることで多少の位置ずれも許容できるので、施蓋が容易となる。また、この場合、図６の光ファイバアレイ断面説明図に示すように、接着剤６ａは段差部Ｃにメニスカス状に溜まり、これが接着力を増す作用を奏する。しかし、ここで発生する応力が、接着剤層が薄い場合では剥離の発生につながる（剥離発生のメカニズムとしてはＶ溝と同様。）。特にこの部分は外側なので外気に曝されているため、剥離が発生すると容易に水分の浸入を許すので、剥離の進行が早くなる。このように、この部位は剥離を防ぐ重要な部分であり、図１のように接着剤層を大きく確保しておけば、応力は集中せずに剥離が発生し難いので、本発明の構成はＶ溝部と同様に高い信頼性を確保できる。ここで、図５（ａ）は本発明にかかる光ファイバアレイの断面説明図、図６（ｃ）は従来の光ファイバアレイの断面説明図を示している。尚、図６（ｂ）に示すように、蓋板の幅を基板の幅より大きい場合きくしても、段差部Ｃにメニスカス状の溜まり部が形成され、本発明の構成即ち接着剤層を大きく確保することで、応力は集中せずに剥離が発生し難く、Ｖ溝部と同様に高い信頼性を確保できる。但し、上述するように、光ファイバアレイの端面研磨を精度良く行うことが難しくなるので、蓋板は基板より狭く形成するのが好ましい。

【００２３】また、図７（ａ）の光ファイバアレイの側面説明図に示すように、光ファイバ先端への応力の集中を緩和するために、Ｖ溝の後端部に段差３ａを設け、Ｖ溝形成面に対して一段下げて基板後部に被覆部搭載面を設けた場合、この段差３ａに接着剤６ａが多量に存在することになり、この部分の接着剤による応力が基板３と蓋板５の間の接着層６に集中することになる。このような構造の場合も、本構成は特に有効であるといえる。更に、図７（ａ）では蓋板５の基盤側端部にＲを設けているが、より応力の緩和を図るために、このように基板側にテーパ乃至Ｒを施すとより好ましい。つまり、多量な接着剤厚から徐々に接着剤層厚Ｙに近づけることでより応力集中を防ぐことができる。

【００２４】尚、この段差部に関しては、段差のエッジにより光ファイバが傷つき易く、この部分に部分的にでも剥離が発生した場合、応力の働きにより更に段差によるファイバの傷つきを助長させる恐れがある。この為、この部分に剥離を発生させないことは非常に重要なポイントとなる。また、上記実施の形態にあっては基板と蓋板とで光ファイバを挟み込んで固定する際、蓋板を光ファイバに当接させて、接着剤層の厚みを光ファイバの基板上突出部の高さと同一としているが、光ファイバが確実にＶ溝に２点接触していれば蓋板を光ファイバに当接させなくとも良い。更に、基板にはＶ溝を複数設けているが、Ｖ溝は１本だけであっても接着剤層を上記の如く形成することで、良好な特性を維持させることができる。

【００２５】

【発明の効果】以上詳述したように、請求項１乃至４の発明によれば、過酷な環境下であっても光ファイバと基板或いは固定基板との間で剥離が発生し難く、良好な特性を維持させることができる。

【００２６】請求項５の発明によれば、請求項１乃至４の何れかの効果に加えて、蓋板の幅と基板の幅が異なるので、メニスカス状の接着剤の溜まり部ができ、接着力が増加する。

【００２７】請求項６の発明によれば、請求項１乃至５の何れかの効果に加えて、光ファイバ先端への応力が緩和されるので、剥離が発生し難い。

【図面の簡単な説明】

【図１】本発明の実施形態の１例を示す光ファイバアレイの断面拡大図である。

【図２】環境試験によるファイバアレイ接着部の変化の様子を説明する為の写真画像であり、（ａ）～（ｄ）は本発明の構成、（ｅ）～（ｈ）は従来の構成である。写真を反転処理して掲示している。

【図３】図２の環境試験で使用した保持部材の説明図である。

【図４】光ファイバアレイの斜視図である。

【図５】図４の１つのファイバ部を拡大した断面説明図である。

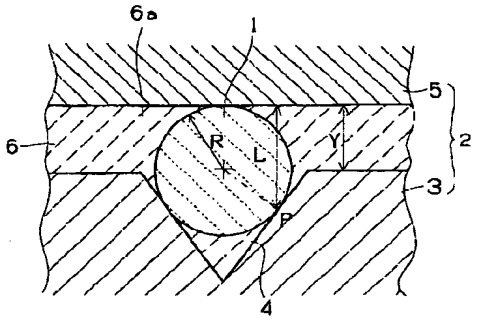
【図６】光ファイバアレイの接着剤層端部の様子を示し、（ａ）は本発明の断面説明図、（ｂ）は本発明の他の例を示す断面説明図、（ｃ）は従来の断面説明図である。

【図７】光ファイバアレイのＶ溝後端部の構成を示し、（ａ）は本発明の要部側面説明図、（ｂ）は従来の要部側面説明図である。

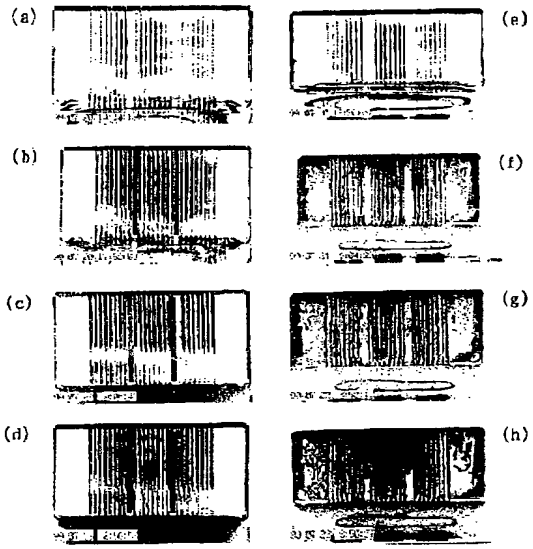
【符号の説明】

１・・光ファイバ、２・・保持部材、３・・基板、３ａ・・段差、４・・Ｖ溝、５・・蓋板、６・・接着剤層、６ａ・・接着剤、Ｌ・・Ｖ溝と光ファイバの接点から蓋板までの距離、Ｍ・・基板最外部の収容溝の中心から基板端部までの距離、Ｐ・・Ｖ溝と光ファイバとの接点、Ｙ・・接着剤層の厚さ。

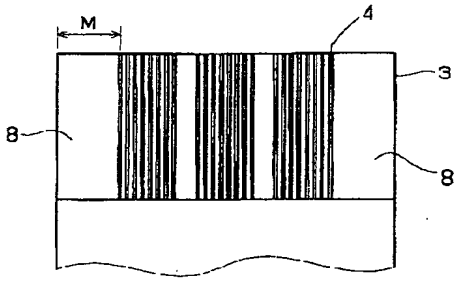
【図１】



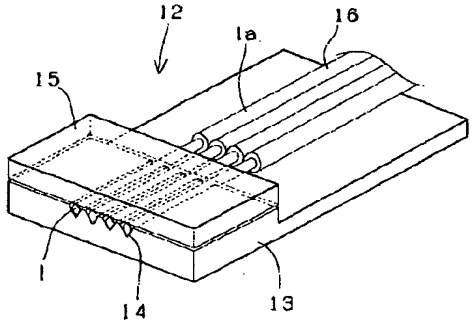
【図２】



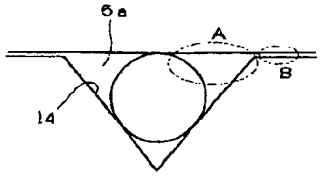
【図３】



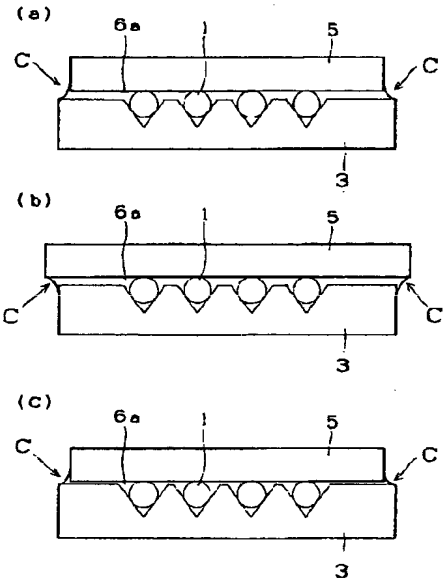
【図４】



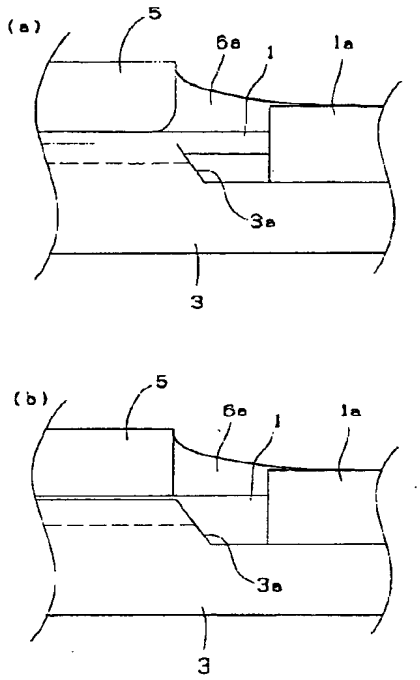
【図５】



【図６】



【図７】



CLAIMS

[Claim(s)]
[Claim 1] In the optical fiber array which is characterized by providing the following and which held optical fiber nose-of-cam **** in the attachment component, was filled up with adhesives between the substrate and the cover plate, and fixed the optical fiber to the hold slot The optical fiber array to which distance from the medial axis of a hold slot which hits the outermost part to a substrate edge is characterized by being L/6 <=Y<=L to the distance L from the contact of the optical fiber and hold slot of an optical fiber radius which have 5 or more times and the distance Y between a substrate and a cover plate held to a cover plate. The substrate in which the hold slot of the shape of a cross section of V characters which holds an optical fiber in the upper surface was formed. It is a wrap cover plate about the upper surface of this substrate.
[Claim 2] The height of abbreviation of the part which projected from the substrate of the optical fiber held in the hold slot is in the distance Y of a substrate and a cover plate by carrying out, and it is an optical fiber array according to claim 1.
[Claim 3] The optical fiber array according to claim 1 or 2 whose distance Y of a substrate and a cover plate is L/4 <=Y<=L.
[Claim 4] An optical fiber array given in the claim 1 or any of 3 they are. [whose adhesives are epoxy systems]
[Claim 5] An optical fiber array given in the claim 1 or any of 4 they are. [from which the width of face of a cover plate and the width of face of a substrate differ]
[Claim 6] An optical fiber array given in the claim 1 or any of 5 they are. [which established the installation side which lays the optical fiber covering section in the posterior part of a hold slot forming face, prepared the level difference between this hold slot forming face and the installation side, and laid and held the optical fiber]

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention equips with an attachment component and relates an optical fiber to a predetermined interval in detail about the optical fiber array which carried out alignment maintenance at the ablation prevention technology of the attachment component.
[0002]
[Description of the Prior Art] The fiber array which carried out alignment fixation of the optical fiber is formed as shown in drawing 4. In drawing 4, 12 holds an optical fiber (optical fiber nakedness section) 1 in each V groove 14, two or more trains formation of cross-section [of V characters]-like V groove 14 (hold slot) is carried out at a substrate, it puts a cover plate 15, puts an optical fiber 1 while it is filled up with adhesives, and it is the attachment component which consists of a substrate 13 and a cover plate 15, and it is carrying out adhesion fixation of the optical fiber 1 at V Mizouchi. Moreover, 1a is the covered optical fiber, is connected two or more and forms the fiber ribbon 16. An attachment component 12 processes a glass plate, and is formed, and V groove 14 is formed in parallel with the substrate front face by which mirror polishing was carried out. Moreover, between adjoining V grooves, since it is narrow, in order to ensure adhesion with a substrate 13 and a cover plate 15, the adhesion side is widely formed in the right-and-left edge of the bunch of a V groove.
[0003]
[Problem(s) to be Solved by the Invention] However, a fiber array which is mentioned above is exposed to -40-degree C low temperature from the elevated temperature which is 60 degrees C in many cases under a field harsh environment, or is exposed to the environment of heat and high humidity from desert environment. Under such a harsh environment, an optical fiber array is stabilized for a long period of time, and must maintain a good property. However, the substrate 13 and cover plate 15 which are fixing the optical fiber 1 by aging separated, and the above-mentioned fiber array had the phenomenon in which fixation of an optical fiber became unstable, when exposed to the bottom of such environment for a long period of time.
[0004] Since transmission loss becomes large between the optics to which the optical axis will have connected it if an optical fiber shifts from a predetermined position, a very high position precision of 0.5 micrometers or less is demanded. Therefore, when the above-mentioned peeling phenomenon occurs, a position gap will occur and a transmission characteristic will deteriorate. Moreover, finally an optical fiber may fall out from a substrate. Then, the technical problem of this invention is being hard to generate ablation of an attachment component etc., even if it is under a harsh environment, and maintaining a good property.
[0005]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention of a claim 1 The substrate in which the hold slot of the shape of a cross section of V characters which holds an optical fiber in the upper surface was formed, In the optical fiber array which held the optical fiber nose of cam in the attachment component which consists the upper surface of this substrate of a wrap cover plate, was filled up with adhesives between the substrate and the cover plate, and fixed the optical fiber nakedness section to the hold slot Distance from the medial axis of a hold slot which hits the outermost part to a substrate edge is characterized by being L/6 <=Y<=L to the distance L from the contact of the optical fiber and hold slot of an optical fiber radius which have 5 or more times and the distance Y between a substrate and a cover plate held to a cover plate.
[0006] In invention of a claim 1, the height of the part which projected from the substrate of the optical fiber held in the hold slot carries out abbreviation etc., is in invention of a claim 2 at the distance Y of a substrate and a cover plate, and it is characterized by things.
[0007] Invention of a claim 3 is characterized by the distance Y of a substrate and a cover plate being L/4 <=Y<=L in a claim 1 or invention of 2. Moreover, invention of a claim 4 is characterized by adhesives being epoxy systems in a claim 1 or invention [which / of 3].
[0008] Invention of a claim 5 is characterized by the width of face of a cover plate differing from the width of face of a substrate in a claim 1 or invention [which / of 4].
[0009] Invention of a claim 6 is characterized by having established the installation side which lays the optical fiber covering section in the posterior part of a hold slot forming face, having prepared the level difference between this hold slot forming face and the installation side, and laying and holding an optical fiber in a claim 1 or invention [which / of 5].
[0010] An artificer according to the adhesives layer between the substrates and cover plates to which the cause of peeling spreads on the hold slot outermost part outside being thin The contraction, the adhesives, and the substrate in the case of the adhesive setting resulting from adhesives ******** of the optical fiber circumference (hold Mizouchi) produced when a circular optical fiber is held in a V groove, Or it traced by experiment that it was in the ability of an adhesives layer not to absorb stress concentration of the adhesives of V Mizouchi by the swelling of adhesives when the difference in the coefficient of thermal expansion of adhesives and a cover plate or humidity is added.
[0011] Since the fiber array is mounted with adhesives, and it gets down and it is carrying out the complicated configuration,

various stress, such as stress, and a strong partial substrate, strong partial stress between [whole] cover plates, exists. As it generates in resin pockets, such as V Mizouchi's fiber circumference, so that it may mention above as partial stress, and this shows in cross-section explanatory drawing of an optical fiber held in V groove 14 of drawing 5 , it joins the portion which the stress of the adhesive pocket shown in A of drawing 5 shows to B, and if the adhesives layer of this portion is thin, it will be thought that it is the mechanism which ablation generates into the portion of B, without the ability absorbing this stress. And if ablation occurs, for example in B etc., that whole stress also joins this portion and when moisture invades into the ablation portion, the ablation will spread further and will go. An adhesives layer is enabled to absorb stress concentration by considering as the above-mentioned composition to an operation of such adhesives, even if it is under a harsh environment, it is hard to generate ablation between an optical fiber, a substrate, or a fixed substrate, and a good property can be maintained.

[0012]

[Embodiments of the Invention] Hereafter, the gestalt of the operation which materialized this invention is explained in detail based on a drawing. Drawing 1 is the cross-section enlarged view of the optical fiber array concerning this invention, an optical fiber (nakedness optical fiber) and 2 are attachment components to which 1 changes from a substrate 3 and a cover plate 5, V groove 4 is formed in a substrate 3, and the optical fiber 1 is held in V groove 4. Moreover, it fills up with adhesives 6a between the circumference of an optical fiber 1 and the substrate 3, and the cover plate 5. In addition, the aperture angle of V groove 4 is 70 degrees, and the radius of an optical fiber 1 is formed by 62.5 micrometers.

[0013] V groove 4 is formed so that a part of optical fiber may project slightly from the substrate upper surface, where an optical fiber 1 is held, and it is formed so that thickness of the adhesives layer 6, abbreviation, etc. by which the protrusion length is formed between a substrate 3 and a cover plate 5 may be spread and may become. Moreover, distance M from the center of the outermost part hold slot of a substrate 3 to a substrate edge (shown in drawing 3 .) is made into 5 or more times of an optical fiber radius to the radius R of an optical fiber 1. And thickness Y of this adhesives layer 6 is specified as follows on the basis of the distance L from the contact P of V groove 4 and an optical fiber 1 to a cover plate 5.

L/6 <=Y<=L .. (range 1)

[0014] By making thickness Y of the adhesives layer 6 into this range, the stress generated from the difference in coefficient of thermal expansion with the contraction generated in case the adhesives layer 6 is hardening of adhesives, as shown in the experimental result mentioned later or a substrate 3, or a cover plate 5, or the difference in the rate of swelling can be absorbed, and the property stabilized without separating also under a harsh environment can be maintained. Moreover, if it sees from a viewpoint of adhesives, the stress by adhesives will become especially large so that the Young's modulus of adhesives is high. For example, since Young's modulus is generally high as compared with the adhesives of acrylic or a silicon system when using the adhesives of an epoxy system, stress also becomes large and becomes effective [the glue-line structure of this application]. Since stress will become large especially if especially Young's modulus uses two or more epoxy 2 kgf(s)/mm system adhesives, the glue-line structure of this application is effective.

[0015] In addition, the adhesives said here show what is used for adhesion of the V groove circumference (adhesion fixation of a nakedness fiber and a cover plate, and a substrate) at least. Moreover, in order for an optical fiber 1 to carry out 2 point contacts to the slant face of V groove 4 certainly, if a process tolerance and the accuracy of measurement are taken into consideration, it will be desirable to make a realistic point of contact into the point which gave about 10 micrometers of margins and moved upwards from a theoretical point of contact, and the above (range 1) will become (L-10 micrometers) / 6 <=Y<= (L-10 micrometers) in this case.

[0016] Table 1 is a table which performed the environmental test (boiling test) by the fiber array which changed and created thickness Y of the adhesives layer 6, and contrasted change of jointing, puts a fiber array into a boiling water, and investigates the generating situation of peeling after predetermined-time progress. In the table, the good state where, as for O, generating of peeling is not seen, the state, in which peeling generated ** in part, and the state where peeling generated x broadly are shown.

[0017]

[Table 1]

接着剤層の厚さ	煮沸時間			
Y	15hr	36hr	60hr	
L/2	○	○	○	写真
L/4	○	○	○	
L/6	○	○	△	
L/8	×	×	×	写真

[0018] Moreover, drawing 2 is a photograph for explaining the situation of change of jointing of the fiber array by the above-mentioned environmental test, (a) - (d) is the photograph of 2 and Y=L[of Table 1]/(e) - (h) is the conventional photograph of Y=L/8. In addition, in order to make a photograph legible, the reversal process was carried out and it has notified. Moreover, the outline of the attachment component 3 of the optical fiber array currently photoed by each photograph of drawing 2 is shown in drawing 3 .

[0019] Drawing 3 is the plan of an attachment component and the attachment component 2 with which the environmental test was presented so that it might illustrate is ******(ing) the group to which a substrate 3 changes from eight V grooves three times. After an optical fiber array's holding an optical fiber 1 in an attachment component 2 and applying adhesives, a cover plate 5 is stuck, it is formed, the amount of protrusions on the substrate of an optical fiber 1 is changed by changing the size of a V groove, and it is made for thickness Y of adhesives to become ******. And in drawing 2 , although change is not seen even if it boils left-hand side photograph (a) - (d) for 60 hours, it can check that the punctate pattern occurred in the main adhesion

sides 8 and 8 of substrate right and left 15 hours after, and a different portion from the state before boiling between each optical fiber group has generated right-hand side photograph (e) - (h). These are the parts to which adhesives exfoliated, and these photographs show that ablation has already occurred in boiling of 15 hours, when right-hand side, i.e., adhesives layer thickness. Y is L/8. Moreover, even if left-hand side, i.e., Y, boils L/2 of things for 60 hours, ablation has not occurred.
[0020] Thus, the distance from the medial axis of a outermost part hold slot to [from a test result] a substrate edge considers as 5 or more times of an optical fiber radius, and if the adhesives thickness Y is L/6 or more, it can be judged also under a harsh environment that it is usable, without almost generating ablation. Furthermore, if the adhesives thickness Y is L/4 or more, it can be judged that it does not generate but ablation continues maintaining a good state.
[0021] By the way, although an optical fiber array has the common form where the fiber was pressed down to substrate V groove 4 at a cover plate 5 and, as for the point end face of an optical fiber array, optical polish is given, since it is necessary to make a fiber end face into a desired angle, polish is performed considering the side usually parallel to V groove 4 as criteria at the time of polish. Under the present circumstances, although it is easy on processing to make the side of a substrate 3 parallel at V groove 4, since a cover plate 5 is only put on an optical fiber 1, it is not easy to make parallel the side and the optical fiber 1 of a cover plate 5.
[0022] Therefore, as for polish datum level, it is natural to make it the side of a substrate 3, and in order to secure this state, it is made not to protrude a cover plate 5 into the right-and-left outside of a substrate 3. Since a position gap of some can also permit the width of face of a cover plate 5 by making it narrower than the width of face of a substrate 3 as this policy, lidding becomes easy. Moreover, as shown in optical fiber array cross-section explanatory drawing of drawing 6 in this case, adhesives 6a collects on the level difference section C in the shape of a meniscus, and does so the operation this [whose] increases adhesive strength. However, the stress generated here leads to generating of ablation in the case where an adhesives layer is thin (ablation generating is the same as that of a V groove as a mechanism.). Since especially this portion is an outside, it is ** (ed) by the open air and permeation of moisture will be easily allowed if ablation occurs, advance of ablation becomes early. Thus, this part is an important portion which prevents ablation, and if the adhesives layer is greatly secured like drawing 1 , since ablation cannot generate stress easily, without concentrating, the composition of this invention can secure high reliability like V slot. Here, in drawing 6 (a), cross-section explanatory drawing of the optical fiber array concerning this invention and drawing 6 (c) show cross-section explanatory drawing of the conventional optical fiber array. in addition, it is hard to generate ablation, without concentrating stress by the thing which hear the width of face of a cover plate when larger than the width of face of a substrate as shown in drawing 6 (b) and for which the shape of a meniscus collects on the level difference section C even if it carries out, the section is formed, and the composition of this invention, i.e., an adhesives layer, is secured greatly, and high reliability can be secured like V slot However, since it becomes difficult to perform end-face polish of an optical fiber array with a sufficient precision so that it may mention above, as for a cover plate, forming more narrowly than a substrate is desirable.
[0023] Moreover, as shown in side explanatory drawing of the optical fiber array of drawing 7 (a), in order to ease concentration of the stress to the nose of cam of an optical fiber When level difference 3a was prepared in the back end section of a V groove, one step is lowered to a V groove forming face and a covering section loading side is established in a substrate posterior part, adhesives 6a will exist in this level difference 3a so much, and the stress by the adhesives of this portion will concentrate on the glue line 6 between a substrate 3 and a cover plate 5. Also in such structure, it can be said that this composition is especially effective. Furthermore, although R is prepared in the base side edge section of a cover plate 5 in drawing 7 (a), in order to aim at relief of stress more, it is more desirable when a taper or R is given to a substrate side in this way. that is, a lot of adhesives thick shells — stress concentration can be prevented more by bringing close to the adhesives thickness Y gradually
[0024] In addition, when an optical fiber tends to get damaged with the edge of a level difference and ablation generates that it is also partial into this portion about this level difference section, there is a possibility of making it promoting with [of the fiber by the level difference] a blemish further by work of stress. For this reason, it becomes the very important point not to make this portion generate ablation. Moreover, if the optical fiber is carrying out 2 point contacts to the V groove certainly, it is not necessary to make a cover plate contact an optical fiber, although a cover plate is made to contact an optical fiber and thickness of an adhesives layer is made the same as that of the height of the substrate top lobe of an optical fiber, in case an optical fiber is put and it fixes by the substrate and the cover plate, if it is in the gestalt of the above-mentioned implementation. Furthermore, although two or more V grooves are prepared in the substrate, a V groove can maintain a good property by forming an adhesives layer like the above, even if it is one.
[0025]
[Effect of the Invention] As explained in full detail above, according to a claim 1 or invention of 4, even if it is under a harsh environment, it is hard to generate ablation between an optical fiber, a substrate, or a fixed substrate, and a good property can be maintained.
[0026] According to invention of a claim 5, since the width of face of a cover plate differs from the width of face of a substrate in addition to a claim 1 or which effect of 4, meniscus-like adhesives collect, the section is made and adhesive strength increases.
[0027] According to invention of a claim 6, since the stress to the nose of cam of an optical fiber is eased in addition to a claim 1 or which effect of 5, it is hard to generate ablation.

[Translation done.]

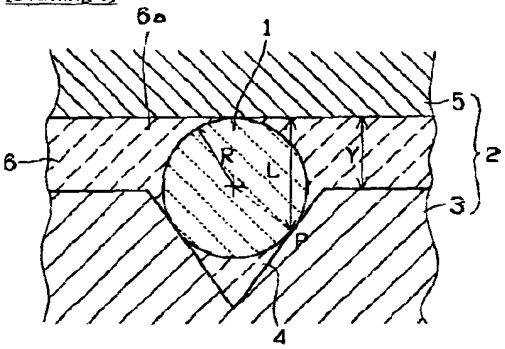
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross-section enlarged view of an optical fiber array showing one example of the operation gestalt of this invention.
[Drawing 2] It is a photograph for explaining the situation of change of fiber array jointing by the environmental test, and (a) - (d) is the composition of this invention and (e) - (h) is the conventional composition. The reversal process of the photograph was carried out and it is put up.
[Drawing 3] It is explanatory drawing of the attachment component used with the environmental test of drawing 2 .
[Drawing 4] It is the perspective diagram of an optical fiber array.
[Drawing 5] It is cross-section explanatory drawing to which the one fiber section of drawing 4 was expanded.
[Drawing 6] Cross-section explanatory drawing in which the situation of the adhesives layer edge of an optical fiber array is shown, (a) shows cross-section explanatory drawing of this invention, and (b) shows other examples of this invention, and (c) are the conventional cross-section explanatory drawings.
[Drawing 7] The composition of the V groove back end section of an optical fiber array is shown, (a) is important section side explanatory drawing of this invention, and (b) is the conventional important section side explanatory drawing.
[Description of Notations]
1 [.. A substrate, 3a / .. A level difference, 4 / .. A V groove, 5 / .. A cover plate, 6 / .. An adhesives layer, 6a / .. Adhesives, L / .. The distance from the contact of a V groove and an optical fiber to a cover plate,, M / .. The distance from the center of the hold slot of the substrate outermost part to a substrate edge, P / .. The contact of a V groove and an optical fiber,, Y] .. An optical fiber, 2 .. A

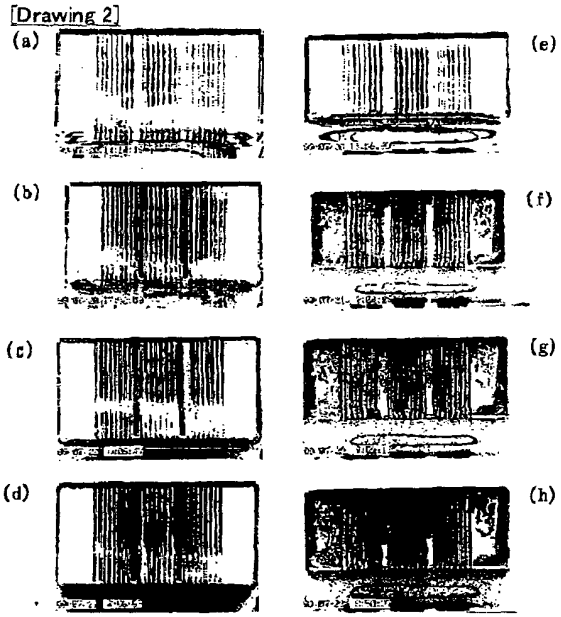
[Translation done.]

DRAWINGS

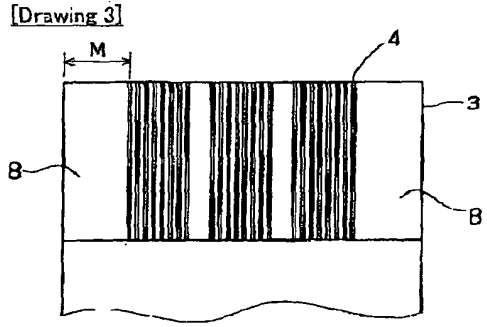
[Drawing 1]



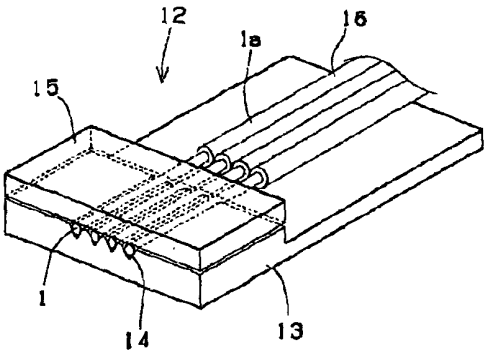
[Drawing 2]



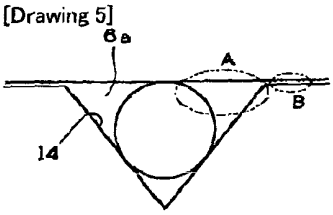
[Drawing 3]



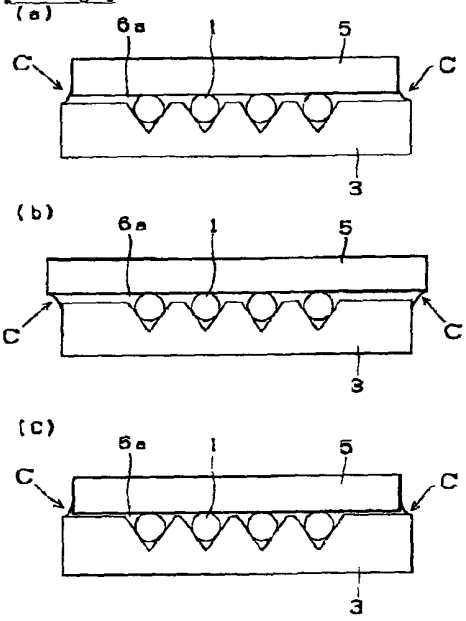
[Drawing 4]



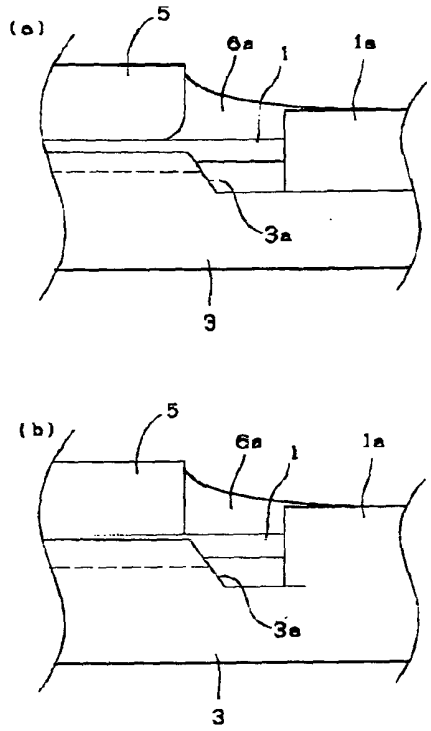
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]